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ABSTRACT

In spring and fall 1988, a two-phase study was conducted at Nassau Community College to evaluate two courses in the mathematics program: Preparatory Mathematics (MAT 001) and Introductory Algebra (MAT 002). Pre- and post-tests for the classes were administered to assess student learning outcomes. The first phase of the study examined aspects of program placement testing and instruction, as well as student characteristics and the percentage of students reaching minimal competency. Phase two focused on student outcomes in MAT 002, student competency in subsequent mathematics courses, and the variables related to student success. Phase one results indicated that course grades in MAT 001 and MAT 002 did not appear to be related to students' scores on the placement tests; mean performance on post-tests showed a statistically significant increase in mathematics knowledge; and 33% of the MAT 001 students and 41% of the MAT 002 students did not complete the course. The results from phase two included the following: (1) pass rates for MAT 002 were substantially higher in fall 1988, a change attributed to improved test validity; (2) MAT 001 students had MAT 002 pass rates similar to those of other students; (3) course pass rates were highest for Business Administration students (86.4%) and among the lowest for Early Childhood students (38.9%); and (4) remediated students' pass rates in three of five higher level math courses were comparable to other students. Detailed data tables are included. (JMC)

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Evaluation of a Two-Year College Remedial/Developmental Mathematics Program

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Overview

The Department of Mathematics/Statistics/Computer Processing of Nassau Community College, a two-year college located in a suburb of New York City, offers a sequence of courses for students whose mathematics background is deficient. The sequence of 0-credit courses consists of MAT 001 (Preparatory Mathematics), essentially an arithmetic course, and MAT 002 (Introductory Algebra), essentially an elementary algebra course. This report describes an in-house evaluation of this program. The evaluation was done in two phases over the course of one year. It was conducted with the support of Nassau Community College which granted release time for that purpose.

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MAT 001-002 Remedial Mathematics
Program Evaluation
Stage 1: Spring 1988

INTRODUCTION

This report presents an evaluation of the MAT 001 -MAT 002 remedial mathematics program for the Spring 1988 semester. It focuses on the character and effectiveness of the program. In it, the following questions are addressed:

1. What are the characteristics of the program as it concerns placement, testing, and instruction?

2. What are the characteristics of the student populations of MAT 001 and MAT 002?

3. What percentage of students in each course are reaching minimal competency?

4. How successful is the program in improving students' mathematics abilities in each course?

When follow-up data is available, following the completion of the Fall 1988 semester, I hope to be able to directly address two other questions of interest. They are:

5. How successful are students from each course in later mathematics courses?

6. What are the retention rates for these students?

The data upon which this report is based came from several sources. Information concerning high school decile, area of concentration, and enrollment figures was culled from data summaries regularly produced by M.I.S., as necessary. Data specific to each student concerning his or her course grade, pre-test and exit exam scores were gathered from class records. Placement exam scores were individually located in the testing results summaries. I was unable to arrange for existing College computer files to be accessed and merged as originally hoped. Therefore, the student-level data had to be entered from scratch into a single data file I established for each course.

The Statistical Package for the Social Sciences (SPSS) was used to do some of the data analyses. The computer programs using SPSS which I wrote for this purpose are included in an appendix to this report.

1. What are the characteristics of the program as it concerns placement, testing, and instruction?

The College administers a placement test to all incoming full-time, first-time matriculated students. Testing takes place at various times throughout the semester. The test currently being used is the TASK test (Stanford Test of Academic Skills), Level 2, published by the Psychological Corporation.

The mathematics portion of the test contains 48 questions covering arithmetic and elementary algebra. Students have 40 minutes in which to complete this portion of the test. Calculator use is allowed on the test, since Math Department policy allows calculators to be used in the remedial classes. In order to give the students an opportunity to "relearn" material on their own before testing, a review sheet developed by the Math Department is included in the mailing advising students of the testing to take place.

The score on the mathematics portion of the placement test is used to discriminate among students who need remediation in basic mathematics (primarily elementary school arithmetic and problem solving), those who need remediation in elementary algebra, and those who need no remediation of this type. According to the documentation accompanying the TASK battery, for the Grade 13 students comprising the standardization sample, a grade equivalent of 8.2 corresponds to a raw score of 17 and a grade equivalent of 9.7 corresponds to a raw score of 23. These raw scores were chosen as cutoff scores for MAT 001 and MAT 002, respectively. Thus, students scoring greater than 23 are not targeted for mathematics remediation; students scoring 17 or below are targeted for remediation in both arithmetic and algebra (MAT 001 followed by MAT 002) since they scored no better than beginning 8th graders would be expected to score; students scoring between 18 and 23 are targeted for remediation in algebra (MAT 002) since they have not done as well as students who completed the 9th grade would be expected to do.

These cutoff scores went into effect late November 1987 for the Spring 1988 semester, and represent more stringent criteria than those used previously. Prior to this, students scoring between 1 and 11 inclusive were placed into MAT 001, and students scoring between 12 and 21 inclusive were placed into MAT 002.

In teaching MAT 001, instructors may use a whole-class lecture approach, group instruction, or individual self-paced instruction. Some instructors use a variety of techniques. For MAT 002, the Department has established that the course must be taught by the structured/lecture technique. Instructors of either course are expected to adhere strictly to the course outline regardless of the teaching approach taken.

The College tested 692 applicants during group testing for the Spring 1988 semester. Of these, 172 students (24.9%) were placed into MAT 001, and 127 students (18.4%) were placed into MAT 002. In that semester, 128 students, day and evening, actually enrolled in MAT 001, and 355 students enrolled in MAT 002.

It is departmental policy that students be "pretested" in class during the first week of classes and should be told this in advance of testing. The test used is an alternate form of the uniform final or exit exam for the course. This testing serves as a verification that the placement was correct. Students who may not have acted on the advice that they review before taking the placement exam have the opportunity to review for themselves before in-class testing, and may "place out" of MAT 001 by scoring a grade of at least 80% on the exam. In order to "place-out" of MAT 002, a grade of at least 70% is needed.

In the Spring 1988 semester, 4 students (3.8% of enrollees) were reassigned from MAT 001 to MAT 002; 8 students (2.6%) were reassigned from MAT 002 into a credit course. Students use the drop-add procedure to register for the next appropriate MAT course in sequence.

2. What are the characteristics of the student populations of MAT 001 and MAT 002?

In the Spring 1988 semester, 104 day and 24 evening students enrolled in MAT 001; 305 day and 50 evening students enrolled in MAT 002. Of the MAT 001 students, approximately 44% students were male and 56% were female. Of the MAT 002 students, approximately 50% were male and 50% were female.

These students were enrolled in a wide variety of different areas of concentration. Among the MAT 001 students, a total of 26 different areas were represented (see Table 1). The largest groups were students enrolled in the Liberal Arts - AA program and the BEP program. These groups accounted for approximately 37% and 14%, respectively, of the total enrollment in MAT 001.

Table 1

Enrollment Summary by Area of Concentration for Spring 1988

MAT 001

Area of Concentration	Number of Students	% of Total Course Enrollment
Accounting	1	0.8
Afro-Amer Studies	1	0.8
LA/ART	2	1.6
Banking,RI Est,Ins.	1	0.8
LA/Biology	4	3.1
Criminal Justice-AS	1	0.8
Business Admin.	4	3.1
Secretarial Science	4	3.1
Data Processing	3	2.3
Fashion Merchandising	3	2.3
Liberal Arts-AA	47	36.7
Liberal Arts-AS	3	2.3
LA/Basic Ed. Prog.	18	14.1
LA/ESL Prog.	9	7.0
Hotel Tech. Admin.	3	2.3
Marketing	2	1.6
Real Estate CF	1	0.8
Computer Science	1	0.8
Early Childhood	3	2.3
Criminal Justice-AAS	3	2.3
Music-AAS	1	0.8
LA/Acting	1	0.8
Retail Management	2	1.6
LA/Allied Hlth Sci	1	0.8
Restaurant Mgt	2	1.6
Word Proc CTF	1	0.8
Unclassified	1	0.8
Unknown	8	6.3

Among the MAT 002 students, a total of 37 different areas of concentration were represented (see Table 2). The largest groups here, too, were students enrolled in the Liberal Arts - AA program and the BEP programs. These groups accounted for approximately 30% and 31%, respectively, of the total enrollment in MAT 002.

Table 3 presents enrollment figures for MAT 001 and MAT 002 broken down by high school decile. Decile ranking was reported for approximately 47% of the MAT 001 students and for approximately 60% of the MAT 002 students. Approximately 83% of the students in MAT 001 whose deciles were known were ranked in the lower half of their high school classes (i.e. deciles 6 through 10). These students accounted for approximately 39% of the total MAT 001 population. For MAT 002, approximately 86% of the students whose deciles were known were ranked in the lower half of their high school classes. These students accounted for approximately 52% of the total MAT 002 population.

The available mathematics placement test data is summarized in Table 4. At the time of the writing of this report, information about a student's raw score on the mathematics portion of the college placement exam had not been retained as part of the student's record. The "Freshman Placement Test Analysis" available through M.I.S. reports the decile in which a student's score lies, and the corresponding math course placement.

The following assignments are made:

Raw Score	Decile	Course Assignment
45-48	1	MAT 100+
41-44	2	MAT 100+
37-40	3	MAT 100+
33-36	4	MAT 100+
29-32	5	MAT 100+
24-28	6	MAT 100+
21-23	7	MAT 002
18-20	8	MAT 002
10-17	9	MAT 001
0-9	10	MAT 001

Table 2

Enrollment Summary By Area of Concentration For Spring 1988

MAT 002

Area of Concentration	Number of Students	% of Total Course Enrollment
Asst Accountant	15	4.2
Accounting	3	0.8
Afro-Amer Studies	1	0.3
LA/Art	3	0.8
Bookkeeping CTF	1	0.3
LA/Biology	6	1.7
Criminal Justice-AS	5	1.4
Business Admin	16	4.5
Sec. Science	4	1.1
Child Care	4	1.1
Data Processing	5	1.4
LA/Pre-Env Sci/Fors	1	0.3
Fashion Merch	2	0.6
LA/Info Proc	1	0.3
Liberal Arts-AA	106	29.9
Liberal Arts-AS	5	1.4
LA/Basic Ed Prog	109	30.7
LA/ESL Prog	4	1.1
Hotel Technology Adm	4	1.1
Marketing	8	2.3
Real Estate CTF	1	0.3
LA/Mathematics	1	0.3
Computer Sci	1	0.3
Small Bus Mgnt CTF	1	0.3
Early Childhood	5	1.4
LA/Phys Ed	2	0.6
Criminal Justice-AAS	1	0.3
Surgical Tech	1	0.3
Music-AAS	1	0.3
LA/Acting	2	0.6
LA/Technl Theatre	1	0.3
Retail Mgmt	2	0.6

Table 2 (continued)

Area of Concentration	Number of Students	% of Total Course Enrollment
LA/ Allied Health Sci	3	0.8
Restaurant Mgmt	2	0.6
Traffic & Trans Syst	1	0.3
Word Processing	2	0.6
Word Processing CTF	1	0.3

Table 3

Enrollment Summary By H.S. Decile for Spring 1988

	MAT 001			MAT 002		
Decile	Frequency	Adjusted Frequency	Cumulative Adj. Freq.	Frequency	Adjusted Frequency	Cululative Adj. Freq.
10	11 8.7%	18.6%	18.6%	46 13.0%	21.6%	21.6%
9	13 10.3%	22.0%	40.6%	52 14.6%	24.4%	46.0%
8	9 7.1%	15.3%	55.9%	36 10.1%	16.9%	62.9%
7	8 6.3%	13.6%	69.5%	30 8.5%	14.1%	77.0%
6	8 6.3%	13.6%	83.1%	19 5.4%	8.9%	85.9%
5	7 5.6%	11.9%	95.0%	14 3.9%	6.5%	92.4%
4	0 0.0%	0.0%	95.0%	9 2.5%	4.3%	96.7%
3	2 1.6%	3.4%	98.4%	6 1.7%	2.8%	99.4%
2	1 0.8%	1.6%	100%	1 0.3%	0.5%	100%
1	0 0.0%	0.0%	100%	0 0.0%	0.0%	100%
GED	14 11.1%			11 3.1%		
None	53 42.1%			131 36.9%		

Table 4

Summary of Scores on the Mathematics Portion of the Placement Exam for Spring 1988

MAT 001

Raw Score	Decile	Frequency	Relative Frequency
0-9	10	4	6.7%
10-17	9	33	55.0%
18+	8+	23	38.3%

MAT 002

Raw Score	Decile	Frequency	Relative Frequency
0-17	9,10	40	15.9%
18-20	8	68	27.0%
21-23	7	126	50.0%
24+	6+	18	7.1%

In order to determine the math placement test decile score for the students in MAT 001 and MAT 002 in the Spring 1988 semester, the "Freshman Placement Test Analysis" reports for Fall 1987 and Spring 1988 were consulted. It was unfeasible to go back further than one year to look for the data for individual students one by one. As a result, placement information was treated as missing for 54.9% of the MAT 001 students and 31.3% of the MAT 002 students.

The cutoffs currently in use send students with scores between 0 and 17, inclusive, to MAT 001. As it turned out, only 4 of the MAT 001 students had a raw score in the lowest interval of 0-9 inclusive. Students with scores between 18 and 23, inclusive, are placed into MAT 002. About half of the students for whom placement information was available had scores on the interval 21-23 (decile 7). Another 16% of the students had originally been placed into MAT 001 with scores between 0 and 17 and were currently taking MAT 002.

Surprisingly, there were 23 students enrolled in MAT 001 who in fact had scores of at least 18 and thus had actually been placed into a more advanced math course. Similarly, there were 18 students enrolled in MAT 002 who had scores of at least 24, and thus had been placed into a credit-bearing mathematics course. It is not known how many of these students, if any, enrolled in lower level courses in error and how many chose to enroll in them in order to improve their skills.

Effective Fall 1988, indicated on the preliminary class rosters is each student's original mathematics placement. This information is used by each professor to verify that the student is enrolled in the correct course. This should go a long way towards eliminating enrollment errors.

3. What percentage of students of each course are reaching minimal competency?

In order to receive an S in MAT 001, a student must receive a minimum score of 80% on a uniform exit exam. In MAT 002, a minimum grade of 70% is required on the exit exam in order to receive an S in the course. These grades reflect the department's judgment of the minimal levels of competency needed in basic mathematics and elementary algebra. A student is permitted to take the exam (actually, a different version) more than once in a semester if he or she does not pass on the previous attempt. Each version of each exit exam contains 33 questions reflecting the course content. They were developed by departmental committees with input from the rest of the department faculty.

A student who does not meet the criterion for passing is given a U in the course. Faculty are discouraged from assigning the grade of W in these courses.

If a student does not receive an S in the course, he or she must re-enroll in it at a future date. At that time, the student will, once again, have the opportunity to place out by passing the pre-test during the first week of classes. Thus, if a student who has not passed but has made substantial progress in the course uses the time between semesters for further study, he or she may pass the pre-test when next given and not have to repeat the course.

According to current N.C.C. policy, a student who does not receive an S in MAT 001 or MAT 002 after having enrolled in the course 3 times is subject to academic dismissal. (The same policy is in effect for all remedial courses.)

MATH COURSE GRADE COMPARISONS

Comparisons of the grade distributions for MAT 001 and MAT 002, Spring 1988, to the grade distributions for other entry-level credit-bearing math courses are presented in Tables 5, 6, and 7. For MAT 001, 58.6% of the students received a grade of S; for MAT 002, 48.7% of the students received a grade of S.

From Table 5 it appears that the passing rate is lower than the passing rate in all but one of the courses MAT 100, 101, 102, 109 and 116. However, these figures are misleading because passing in MAT 001 is contingent upon earning a grade of at least 80%, that is a B, whereas passing in a credit course means a minimum grade of D was earned.

A more meaningful comparison is between the percent of students passing MAT 001 and the percent of students earning at least a B in a credit bearing course. These comparisons appear in Table 6. Using this criterion for passing, the passing rate for MAT 001 (58.6%) was higher than for each of the courses MAT 100, 101, 102, 109 and 116.

Similarly, although it appears from Table 5 that the passing rate for MAT 002 is substantially lower than the passing rate for each of the credit courses listed, this comparison is misleading. Passing MAT 002 is contingent upon earning a grade of at least 70%, that is a C, whereas passing in a credit course means a minimum of D was earned.

Table 5

Grade Distribution Analysis by Subject for Spring 1988

	MAT 001	MAT 002	MAT 100	MAT 101	MAT 102	MAT 109	MAT 116	MAT 100-116
S*	75	173	281	769	1091	408	38	2587
	(58.6%)	(48.7%)	(72.4%)	(74.4%)	(69.3%)	(66.9%)	(55.1%)	(70.4%)
U	50	149	10	67	140	38	19	274
	(39.1%)	(42.0%)	(2.6%)	(6.5%)	(8.9%)	(6.3%)	(2.8%)	(7.5%)
W	3	31	91	189	318	160	12	770
	(2.3%)	(8.7%)	(23.5%)	(18.3%)	(20.2%)	(26.2%)	(1.7%)	(21.0%)
INC	0	2	6	8	26	4	0	44
	(0.0%)	(0.6%)	(1.5%)	(0.8%)	(1.7%)	(.7%)	(0.0%)	(1.2%)
TOTAL	128	355	388	1033	1575	610	69	3675

*For credit courses, S represents any passing grade, A through D; U represents a grade of F.

Table 6

Analysis of the Percentage of Students Earning a Minimum of B

	MAT 001	MAT 100	MAT 101	MAT 102	MAT 109	MAT 116	MAT 100-116
S*	75	137	439	763	214	20	1573
	(58.6%)	(35.3%)	(42.5%)	(48.4%)	(35.1%)	(29.0%)	(42.8%)
U	50	154	397	468	232	37	1288
	(39.1%)	(39.7%)	(38.4%)	(29.7%)	(38.0%)	(53.6%)	(35.0%)
W	3	91	189	318	160	12	770
	(2.3%)	(23.5%)	(18.3%)	(20.2%)	(26.2%)	(17.4%)	(21.0%)
INC	0	6	8	26	4	0	44
	(0.0%)	(1.5%)	(0.8%)	(1.7%)	(.7%)	(0.0%)	(1.2%)
TOTAL	128	388	1033	1575	610	69	3675

*For credit courses, S represents a grade of A through B; U represents a grade of C+ through F.

A more meaningful comparison appears in Table 7, for which "passing" was reinterpreted to mean of grade of C. Although MAT 002 still has the lowest passing rate (48.7%), the differences are not as great as it may have seemed initially, with the other passing rates ranging from 49.3% to 64.0%.

Since faculty are advised not to give W's in MAT 001 or MAT 002, it is not apparent from the data in this table whether students who don't pass are pulling out before the end or are completing it but not passing. The data concerning the exit exam sheds some light on this. Approximately 39% of the students in MAT 001 and 002 in Spring 1988 did not take the exit exams, although all attending students were given the opportunity to do so.

AREA AND DEPARTMENT OF CONCENTRATION

A breakdown of the grades received in MAT 001 by student area of concentration, for the Spring 1988 semester, appears in Table 8. It is apparent that most areas had very few students taking MAT 001. As previously noted, the two largest concentrations were 18 students from the BEP program, and 47 students from the Liberal Arts - AA degree program. The passing rates for students in these areas were 72.2% and 55.3%, respectively, compared to an overall passing rate of 58.6% for MAT 001. Thus, in general, it does not appear that any one area of concentration has been more substantially affected than any other with respect to students not successfully completing MAT 001.

A breakdown of the grades received in MAT 002 by student area of concentration for the Spring 1988 semester appears in Table 9. As was the case with MAT 001, again the two largest concentrations were in the Liberal Arts - AA program, with 106 students, and the BEP program, with 109 students. The passing rates were 52.8% and 42.2% respectively, compared to an overall passing rate of 48.7% for MAT 002. Thus, in general, it does not appear that any one area of concentration has been more substantially affected than any other, with respect to students not successfully completing MAT 002 during the Spring 1988 semester.

In this analysis, I was unable to identify and thus take into account the area of concentrations initially chosen by students placed into the BEP program.

Table 7

Analysis of the Percentage of Students
Earning a Minimum of C

	MAT 002	MAT 100	MAT 101	MAT 102	MAT 109	MAT 116	MAT 100-116
S*	173 (48.7%)	232 (59.8%)	659 (63.8%)	1007 (64.0%)	340 (55.7%)	34 (49.3%)	2272 (61.8%)
U	149 (42.0%)	59 (15.2%)	177 (17.1%)	224 (14.2%)	106 (17.4%)	23 (33.3%)	589 (16.0%)
W	31 (8.7%)	91 (23.5%)	189 (18.3%)	318 (20.2%)	160 (26.3%)	12 (17.4%)	770 (21.0%)
INC	2 (0.6%)	6 (1.5%)	8 (0.8%)	26 (1.7%)	4 (0.7%)	0 (0.0%)	44 (1.2%)
Total	355	388	1033	1575	610	69	3675

*For credit courses, S represents a grade of A through C; U represents a grade of D+ through F.

Table 8

Grade Distribution Summary By Area Of Concentration For Spring 1988

MAT 001

Area of Concentration	Number of Students	%S	%U	%W
Accounting	1	00.0	100.	00.0
Afro-Amer Studies	1	00.0	100.	00.0
LA/Art	2	50.0	50.0	00.0
Banking,Rl Est,Ins	1	100.	00.0	00.0
LA/Biology	4	100.	00.0	00.0
Criminal Justice-AS	1	00.0	100.	00.0
Business Admin	4	25.0	75.0	00.0
Secretarial Science	4	50.0	50.0	00.0
Data Processing	3	100.	00.0	00.0
Fashion Merchandising	3	33.3	66.7	00.0
Liberal Arts-AA	47	55.3	40.4	4.2
Liberal Arts-AS	3	67.7	33.3	00.0
LA/Basic Ed Prog	18	72.2	27.8	00.0
LA/ESL Prog	9	55.6	44.4	00.0
Hotel Tech. Adm.	3	66.7	33.3	00.0
Marketing	2	100.	00.0	00.0
Real Estate CF	1	100.	00.0	00.0
Computer Science	1	100.	00.0	00.0
Early Childhood	3	33.3	66.7	00.0
Criminal Justice- AAS	3	33.3	33.3	33.3
Music-AAS	1	00.0	100.	00.0
LA/Acting	1	100.	00.0	00.0
Retail Management	2	100.	00.0	00.0
LA/Allied Hlth Sci	1	00.0	100.	00.0
Restaurant Management	2	50.0	50.0	00.0
Word Proc CTF	1	100.	00.0	00.0
Unclassified	1	00.0	100.	00.0
Unknown	8	67.5	32.5	00.0

Table 9

Grade Distribution Summary by Area of Concentration for Spring 1988

MAT 002

AREA OF CONCENTRATION	NUMBER OF STUDENTS	%S	%U	%W
Asst. Accountant	15	33.3	66.7	
Accounting	3	66.7		33.3
Afro-Amer Studies	1	100.0		
LA/Art	3	33.3	33.3	33.3
Bookkeeping CTF	1	100.0		
LA/Biology	6	50.0	33.3	16.7
Criminal Justice-AS	5	40.0	60.0	
Business Admin	16	43.8	50.0	6.2
Sec. Science	4	75.0	25.0	
Child Care	4	75.0	25.0	
Data Processing	5	60.0		40.0
LA/Pre-Env Sci/Fors	1	100.0		
Fashion Merch	2	50.0		50.0
LA/Info Proc	1		100.0	
Liberal Arts-AA	106	52.8	34.9	12.3
Liberal Arts-AS	5	80.0	20.0	
LA/Basic Ed Prog	109	42.2	54.1	3.7
LA/ESL Prog	4	50.0	50.0	
Hotel Technology Adm	4	25.0	25.0	25.0
Marketing	8	37.5	62.5	
Real Estate CTF	1		100.0	
LA/Mathematics	1		100.0	
Computer Sci	1	100.0		
Small Bus Mgnt CTF	1	100.0		
Early Childhood	5	80.0	20.0	
LA/Phys Ed	2	50.0		50.0
Criminal Justice-AAS	1		100.0	
Surgical Tech	1	100.0		
Music-AAS	1	100.0		
LA/Acting	2		50.0	50.0
LA/Technl Theatre	1		100.0	
Retail Mgmt	2	50.0	50.0	
LA/Allied Health Sci	3	66.7	33.3	

Table 9 (continued)

AREA OF CONCENTRATION	NUMBER OF STUDENTS	%S	%U	%W
Restaurant Mgmt	2	50.0	50.0	
Traffic & Trans Syst	1		100.0	
Word Processing	2	50.0	50.0	
Word Processing CTF	1	100.0		

Table 10

Grade Distribution Summary By Department
of Concentration for Spring 1988

MAT 001

Department of Concentration	Number of Students	% S	% U	% W
Accounting & Bus Ad	7	42.9	57.1	
Allied Health Sci	1		100.0	
Hotel & Rest Mgmt	8	60.0	40.0	
Marketing & Retailing	7	71.4	28.6	
Math/Stat/Comp Proc	4	100.0		
Psych, Child Care, Early Child	3	33.3	66.7	
Secretarial/Office Tech	5	60.0	40.0	
Theatre and Dance	1	100.0		
Afro-Amer Studies	1		100.0	
Art	2	50.0	50.0	
Biology	4	100.0		
Criminal Justice	4	25.0	50.0	25.0
Liberal Arts - AA	47	55.3	40.4	4.2
Liberal Arts - AS	3	67.7	33.3	
ESL	9	55.6	44.4	
BEP	18	72.2	27.8	
Unclassified	1		100.0	
Unknown	8	67.5	32.5	

Table 11

Grade Distribution Summary By Department
of Concentration for Spring 1988

MAT 002

Department of Concentration	Number of Students	% S	% U	% W
Accounting and Bus Ad	27	59.3	33.3	7.4
Allied Health Sci	4	75.0	25.0	
Hotel & Rest Mgmt	6	33.3	33.3	16.7
Marketing & Retailing	12	41.7	50.0	8.3
Math/Stat/Comp Proc	9	44.4	33.3	22.2
Psych, Child Care, Early Child	9	77.8	22.2	
Secretarial/Office Tech	7	71.4	28.6	
Theatre and Dance	3		100.0	
Afro-Amer Studies	1	100.0		
Art	3	33.3	33.3	33.3
Biology	6	50.0	33.3	16.7
Criminal Justice	6	33.3	66.7	
Env. Sci./Forestry	1	100.0		
Liberal Arts - AA	106	52.8	34.9	12.3
Liberal Arts - AS	5	80.0	20.0	
ESL	4	50.0	50.0	
BEP	109	42.2	54.1	3.7
Health, Phys. Ed, Rec	2	50.0		50.0
Music	1	100.0		

Table 12

Grade Distribution Summary By High School Decile For Spring 1988

MAT 001

Decile	Total	%S	%U	%W
1	0			
2	1	100.	00.0	00.0
3	2	50.0	50.0	00.0
4	0			
5	7	57.1	42.9	00.0
6	8	87.5	12.5	00.0
7	8	62.5	37.5	00.0
8	9	66.7	22.2	11.1
9	13	53.8	46.2	00.0
10	11	45.5	54.5	00.0
GED	14	71.4	28.6	14.3
NONE	53	52.7	43.6	3.6

Table 13

Grade Distribution Summary By High School Decile
for Spring 1988

MAT 002

Decile	Total	% S	% U	% W
1	0	100.		
2	1	50.0	00.0	00.0
3	6	88.9	16.7	33.3
4	9	64.3	00.0	11.1
5	14	57.9	28.6	7.1
6	19	66.7	42.1	00.0
7	30	50.0	30.0	3.3
8	36	36.5	47.2	2.8
9	52	34.8	42.3	21.2
10	46	27.3	54.3	8.7
GED	11	49.6	72.7	00.0
None	131		42.0	7.6

Since some departments offer several different areas of concentration, the data were reanalyzed by department rather than area. The resulting breakdowns appear in Tables 10 and 11. For MAT 001, the combining data in this way affected the distributions for eight departments. Of these, the highest concentration of MAT 001 students was found in the Department of Hotel and Restaurant Management, with 8 students. The passing rate for this group was 60%, which is above the overall passing rate of 58.6%. The departments of Marketing and Retailing, and Accounting and Business Administration had the next highest concentrations, with 7 students each enrolled in MAT 001. The passing rates for these groups were 71.4% and 42.9% respectively. The latter passing rate is somewhat below the overall passing rate; the former is substantially above average.

A similar breakdown for the data for MAT 002 shows that of the departments offering several programs, the departments of Marketing and Retailing, and Accounting and Business Administration had the highest concentration of MAT 002 students. Of the 12 students from the department of Marketing and Retailing, 41.7% passed MAT 002. This is close to, although below, the overall passing rate of 48.7%. Of the 27 students from the department of Accounting and Business Administration, 59.3% passed MAT 002. This passing rate is above the overall passing rate of 48.7%. Thus, after taking both numbers of students and passing rate into account, it does not appear that any one department has been much more substantially affected than any other with respect to its students passing MAT 002.

HIGH SCHOOL DECILE

Tables 12 and 13 address the question of whether success in MAT 001 or MAT 002 is related to the student's high school decile. Among MAT 001 students, only those in the lowest high school decile had a passing rate of less than 50%, at 45.5%. Among MAT 002 students, passing rates of below 50% were found for decile 9 and decile 10 students, at 36.5% and 34.8%, respectively. For students who had earned general equivalency diplomas, the passing rate in MAT 001 was high at 71.4%. However, in MAT 002, GED students had the lowest passing rate of any group, at 27.3%.

MATHEMATICS PLACEMENT EXAM SCORE

To examine whether success in MAT 001 or MAT 002 is related to the score earned on the mathematics section of the placement exam, several statistical analyses were done. The data consisted of each student's math placement decile score from ES - 124, grade in the course from the final grade sheets, and in-class post-test or exit exam score, from the tests themselves. The data was manually entered into a data file designed for this purpose.

In the first analysis concerning MAT 001, the student population was broken into groups corresponding to the decile scores of 10, 9, or higher than 8 (meaning the students who were self-placed) on the math portion of the placement exam. Only those students who actually completed the course and, therefore, received a grade of S or U were included. This restriction, combined with the fact that placement score data could not be obtained for all students, resulted in 78 missing observations, leaving a total of 55 observations for statistical analysis.

The resulting crosstablulation of math placement test decile score and course grade appears in Table 14. A chi square value of 1.379 was obtained, which is not significant at the .05 level. This indicates that student grade in the course is not dependent upon math placement decile score in general.

The data was reanalyzed including those students who received W grades. Because these students did not successfully complete the course, they were included in the same category as those who received U's. The resulting crosstablulation appears in Table 15. A chi square value of 1.049 was obtained which, again, is not statistically significant at the .05 level.

The second analysis was designed to determine whether those students who were placed into MAT 001 did any differently in the course than those who had been placed into a higher level math course, although they enrolled in MAT 001. Only students receiving a grade of S or U were included. As before, this restriction combined with the fact that placement scores were not obtainable for all students resulted in missing observations, leaving a total of 55 observations for statistical analysis.

Table 14

S/U Distribution by Mathematics Placement Decile for Spring 1988

MAT 001

Math Placement Decile	Course Grade S	Course Grade U
0-8	10 (47.6%)	11 (52.4%)
9	18 (60.0%)	12 (40.0%)
10	3 (75.0%)	1 (25.0%)
TOTAL	31 (56.4%)	24 (43.6%)

Table 15

Passed/Did Not Pass Distribution by Mathematics Placement Decile for Spring 1988

MAT 001

Math Placement Decile	Course Grade S	Course Grade U/W
0-8	10 (47.6%)	11 (52.4%)
9	18 (54.5%)	15 (45.5%)
10	3 (75.0%)	1 (25.0%)
TOTAL	31 (53.4%)	27 (46.6%)

The resulting crosstabulation of math placement test score and course grade appears in Table 16. A corrected chi square value of .4545 was obtained, which is not statistically significant at the .05 level. Thus, student grade in the course (S or U) was not dependent upon original course placement. One might speculate that the students who "placed themselves" into MAT 001 were correct in their judgments.

The data was reanalyzed including those students who received W grades. Because these students did not successfully complete the course, they were included in the same category as those who received U's. The resulting crosstabulation appears in Table 17. A corrected chi square value of .6916 was obtained which, once again, is not statistically significant at the .05 level.

Similar analyses were done for the MAT 002 data to determine whether success in the course is related to score on the mathematics portion of the placement exam. In the first analysis of MAT 002 data, the student population was broken into groups corresponding to deciles 10, 9, 8, 7, and 6 or higher. The last group represents students whose score did not place them into either non-credit math course. Students in deciles 7 and 8 had been originally placed into MAT 002; those in deciles 9 and 10 had been placed into MAT 001. Only those students who actually completed the course and thus received a grade of S or U were included. This restriction, combined with the fact that placement score data could not be obtained for all students resulted in 138 missing observations, and left a total of 229 observations for statistical analysis.

The resulting crosstabulation of math placement decile score and course grade appears in Table 18. A chi square value of 11.601 was obtained, which is significant at the .05 level. Thus, it appears that grade in MAT 002 (S or U) is related to placement decile score. However, looking at the passing rates within each placement score category, one notices that the highest passing rate (88.9%) was for students who scored 24 or higher on the math placement exam and who therefore had not actually been placed in a non-credit math course. To determine if the relationship between grade in MAT 002 and placement decile score existed for students who had actually been placed into a non-credit math course a second data analysis was undertaken in which the decile 1-6 group was omitted.

Table 16

S/U Distribution By Original Course Placement For Spring 1988

MAT 001

		Course Grade S	Course Grade U
Math Placement	MAT 002 or higher	10 (47.6%)	11 (52.4%)
	MAT 001	21 (61.8%)	13 (38.2%)
	TOTAL	31 (56.4%)	24 (43.6%)

Table 17

Passed/Did Not Pass Distribution By Original Course Placement for Spring 1988

MAT 001

Math Placement	Course Grade S	Course Grade U or W
MAT 002 or higher	10 (47.6%)	11 (52.4%)
MAT 001	21 (56.8%)	16 (43.2%)
Total	31 (53.4%)	27 (46.6%)

Table 18

S/U Distribution By Mathematics Placement Decile For Spring 1988

MAT 002

Math Placement Decile	Course Grade S	Course Grade U
0-6	16 (88.9%)	2 (11.1%)
7	58 (50.9%)	56 (49.1%)
8	28 (46.7%)	32 (53.3%)
9	19 (52.8%)	17 (47.2%)
10	0 (0.0%)	1 (100.0%)
Total	121 (52.8%)	108 (47.2%)

The resulting cross-tabulation for the 211 observations appears in Table 19. The chi square value of 1.408 is not statistically significant at the .05 level. The significant "disappearing" when the decile 1-6 group is omitted suggests that this group accounted for the originally perceived relationship between mathematics placement test decile score and grade (S or U) in MAT 002.

As was the case with the MAT 001 data, this MAT 002 data was reanalyzed including those students who received W grades in the same category as those who received U's, rather than omitting those given W's entirely. The results of these analyses were the same as those just discussed. Course grade and placement decile were shown to be related when the decile 1-6 group (students not placed into other non-credit course) was included (chi square = 14.126, $p < .01$, see Table 20) but are independent of each other if the students in deciles 1-6 are omitted (chi square = 1.406, $p > .05$) see Table 21.

The results of these analyses suggest that the passing rate in MAT 002 was not significantly different for students who had first taken MAT 001 then for those who had not. This hypothesis was tested directly in two analyses. In the first, passing and not passing rates (i.e. S vs. U or W) were examined for students grouped by whether they had originally been placed into MAT 001, and thus are assumed to have taken both MAT 001 and MAT 002, or had been placed directly into MAT 002 (see Table 22). In the second analysis, the same groups were created but those students who received W's were eliminated (i.e. S vs. U) (see Table 23). In neither case was the chi square value found to be statistically significant at the .05 level (corrected Chi square $_1$ = .019; corrected chi square $_2$ = .001), supporting the hypothesis. This suggests that students who successfully complete MAT 001 have indeed achieved the level of competency required for placement into MAT 002, and are then just as prepared for the course.

Pre-Test Score

The in-class pre-test provided a measure of a student's entering level of knowledge specific to the course. The mean pre-test score of the 59 students who received an S in MAT 001 was 67.0%; the mean pre-test score of the 36 students who received a U or W in MAT 001 was 61.7%. The difference in means was statistically significant ($p < .06$). Similarly, in MAT 002, the mean pre-test score of 36.1% for the 126 students who received an S was significantly higher statistically than the mean score of 28.5% for the 101 students who received a U ($p < .01$).

Table 19

S/U Distribution For Spring 1988, By Mathematics Placement Decile, For Students Placed Into A Non-Credit Math Course

MAT 002

Math Placement Decile	Course Grade S	Course Grade U
7	58 (50.9%)	56 (49.1%)
8	28 (46.7%)	32 (53.3%)
9	19 (52.8%)	17 (47.2%)
10	0 (0.0%)	1 (100%)
Total	105 (49.8%)	106 (50.2%)

Table 20

Pass/Did Not Pass Distribution by Mathematics Placement Decile for Spring 1988

MAT 002

Math Placement Decile	Course Grade S	Course Grade U or W
0-6	16 (88.9%)	2 (11.1%)
7	58 (46.4%)	67 (53.6%)
8	28 (41.8%)	39 (58.2%)
9	19 (48.7%)	20 (51.3%)
10	0 (0.0%)	1 (100%)
Total	121 (48.4%)	129 (51.6%)

Table 21

Pass/Did Not Pass Distributions for Spring 1988, By Mathematics Placement Decile, For Students Placed Into a Non-Credit Math Course

MAT 002

Math Placement Decile	Course Grade S	Course Grade U or W
7	58 (46.4%)	67 (53.6%)
8	28 (41.8%)	39 (58.2%)
9	19 (48.7%)	20 (51.3%)
10	0 (0.0%)	1 (100%)
Total	105 (45.3%)	127 (54.7%)

Table 22

Pass/Did Not Pass Distributions for Spring, 1988, By Original Placement, For Students Placed Into A Non-Credit Math Course

		Course Grade	
		S	U or W
Math Placement	MAT 001	19 (47.5%)	21 (52.5%)
	MAT 002	86 (44.8%)	106 (55.2%)
	TOTAL	105 (45.3%)	127 (54.7%)

Table 23

S/U Distributions for Spring 1988, By Original Placement, For Students Placed Into A Non-Credit Math Course

MAT 002

		Course Grade S	Course Grade U
Math Placement	MAT 001	19 (51.4%)	18 (48.6%)
	MAT 002	86 (49.4%)	88 (50.6%)
	Total	105 (49.8%)	106 (50.2%)

Thus, in both MAT 001 and MAT 002, students who passed the course seem to have known more of the course work initially than those who did not pass.

4. How successful is the program in improving students's mathematics abilities in each course?

EXIT EXAM SCORES

In non-credit math courses, the grades which may be assigned are restricted to S,U, and W. The exit exam, or post-test score, gives us information about how well the students did, not just whether they did well enough to pass.

For the 68 MAT 001 students who passed the course, the mean post-test score was 80.7%; for the 10 MAT 001 students who completed the course (thereby taking the post-test) but did not pass, the mean post-test score was 62.4%. The difference in these means is statistically significant beyond the .01 level.

For MAT 002, the 143 students who passed the course had a mean post-test score of 75.7%; the 36 students who took the post-test but did not pass had a mean post-test score of 44.9% The difference between these means is statistically significant beyond the .01 level.

It is certainly not surprising to have found that students who passed each course scored higher than those who failed. However, the result is important because it indicates that the exit exams are doing their jobs in discriminating between the two groups - that the differences between passing and failing detected by the exam are not due to chance.

GRADE EQUIVALENTS AND PLACEMENT SCORES

Of course, not all S's or U's are created equal. In MAT 001, a student needs to earn a minimum of B on the exit exam to demonstrate minimum competency; in MAT 002 a minimum of C is needed. As a result, one student's U in MAT 001 may, for example, correspond to a C+ and another's to an F. Thus, despite the fact that whether a student placed into either course passed or failed was not found to be related to math placement score, it remained possible that the better prepared students did do better on the exit exams.

To examine this possibility, students' scores were transformed into letter grade equivalents in the usual fashion (90 through 100 = A; 85 through 89 = B+, etc.), and were broken down by placement score. Unfortunately because 48 students never showed up for the exit exam in MAT 001, and placement scores were unavailable for another 45, we were left with only 35 MAT 101 students for whom both pieces of information were available. This number was so small that analysis of the available cases would not have been meaningful, and so it has not been included here.

For the MAT 002 group, there were 122 students who took the exit exam for whom the placement score had been obtained. The data for this group is summarized in Table 24. Not surprisingly, the students who scored in the 6th decile or higher on the placement exam (and had therefore not actually been placed in a non-credit course) had the largest percentage of A's, B+'s, and B's and C+'s on the exit exam of any group. This supports a previous result. Comparing cumulative frequencies for the remaining groups, we see that the higher the decile score, the higher the percentage of students who scored at least a B+ on the exit exam, scored at least a B on the exit exam, and scored at least a C+ on the exit exam. This was not the case for the percentage of students scoring at least a C on the exit exam, but was not markedly different either. this data seems to suggest something intuitively true - that the higher the student's entering level of knowledge, the higher his level of knowledge upon completing MAT 002 tends to be.

ACHIEVEMENT

Knowing whether a student passed the course tells us whether the student reached a level of minimum competency. Knowing the exit exam score tells us something about what "level of knowledge" was reached. however, neither gives much insight into how much was actually learned. It makes sense to be concerned not only with passing rates and final grades, but with achievement as well. The improvement in test score from the in-class pre-test to the exit exam, or post-test the "gain score" - is used here as a measure of achievement in the course.

One very obvious and important question that may be asked is: "Did students' mathematics abilities improve as a result of the course?" A paired t-test was done on the data to test the obvious hypothesis that the mathematics abilities of students in each course who actually completed the course (thereby taking the exit exam) improved over the course of the semester.

Table 24

MAT 002 Exit Exam Grade Equivalents
Broken Down By Math Placement Decile*
Spring 1988

	Decile 9		Decile 8		Decile 7		Decile 6 or higher	
	Freq.	Cum. Freq.	Freq.	Cum. Freq.	Freq.	Cum. Freq.	Freq.	Cum. Freq.
A	0		1		2		3	
	0.0%	0.0%	3.3%	3.3%	3.3%	3.3%	18.8%	18.8%
B+	0		0		5		3	
	0.0%	0.0%	0.0%	3.3%	8.3%	11.6%	18.8%	37.6%
B	2		4		5		3	
	11.1%	11.1%	13.3%	16.6%	8.3%	19.9%	18.8%	56.4%
C+	1		2		6		2	
	5.6%	16.6%	6.7%	23.3%	10.0%	29.9%	12.5%	68.9%
C	5		10		14		0	
	27.8%	44.4%	33.3%	56.6%	23.3%	53.2%	12.5%	81.4%
D through F	10		13		28		3	
	55.6%	100.0%	43.4%	100.0%	46.6%	100.0%	18.8%	100.0%
Total	18		30		60		14	

*There was no complete data for anyone in the tenth decile.

Reassuringly, the hypothesis was confirmed for each course. In MAT 001 the mean pre-test score was 65.9% and the mean post test score was 78.4% for the 66 students who took both pre and post-tests. The difference in means was significant beyond the .01 probability level ($t = 10.64$). In MAT 002, the mean pre-test score was a surprisingly low 32.9% and the mean post-test score was 68.6% for the 148 students who took both pre and post-tests. The difference in means was significant beyond the .01 level. Why the mean gain from pre-test to post-test should be so substantially greater for MAT 002 compared to MAT 001 is unclear. Note, however, that only very low pre-test scores made a gain of 35.7 percentage points even possible. It would be interesting to know if this difference is found again for Fall 1988 classes.

The possibility exists that a student who did not pass the course still improved as much as one who passed (the problem being that he or she knew less of the material to begin with). We may ask which group of students, if either, improved the most - those who passed the course or those who did not. To answer this question, gain scores from pre-test to post-test were compared.

For the MAT 001 students, the mean gain was 14.3 percentage points for the 57 who passed the course, but a mere 1.4 percentage points for the 9 who failed. For the MAt 002 students, the mean gain was 40.1 percentage points for the 117 who passed, but only 17.7 percentage points for the 26 who failed. In each of these cases, the difference in means was determined to be statistically significant beyond the .01 level ($t_1 = 4.19$; $t_2 = 7.90$). This suggests that students who failed did so not simply because they had further to go to reach minimal competency. They actually learned less than those who passed.

Including students who officially withdrew, approximately 33% of the MAT 001 students and 41% of MA^T 002 students did not complete the course by taking the exit exam. Some students who didn't take the exit exam gave up because they assumed they wouldn't pass. Unfortunately, we have no way of knowing how much these students' mathematics abilities improved.

CONCLUSIONS

As detailed in the report, the following generalizations seem to be suggested by the data for the Spring 1988 semester:

- When the different criteria for passing were taken into account, the passing rate for MAT 001 was somewhat higher, but comparable to the passing rates for entry-level credit math courses; the passing rate for MAT 002 was somewhat lower but comparable to the passing rates for entry-level credit math courses.

- A substantial number of students did not complete MAT 001 and MAT 002, as evidenced by their not taking the exit exam.

- Taking both numbers of students and passing rates into account, it does not appear that any one area of concentration has been more greatly affected by students not successfully completing MAT 001 and MAT 002.

- Student grade in MAT 001 did not seem to be related to decile score on the mathematics placement exam. The same is true for MAT 002, with the exception that students who had not actually been required to take the course did better than those for whom the course was required.

- Students who passed MAT 001 then did as well in MAT 002 as those students placed directly into MAT 002.

- The exit exams seemed to have adequately discriminated between those who passed each course and those who failed.

- In general, the higher a student's math placement decile, the higher the student's exiting level of knowledge of MAT 002 appeared to be.

- Students' mathematics abilities improved as a result of taking MAT 001 or MAT 002.

- Those who passed each course improved more and knew more initially than those who did not pass.

MAT 001-002 Remedial Mathematics
Program Evaluation

Stage 2: Fall 1988

1. Introduction

No substantive changes were made in the MAt 001 part of the program since the Spring 1988 semester. However, one important change was implemented that affected the MAt 002 part of the program. That is, the in-class pretests and exit exams for MAT 002 were substantially revised. In response to faculty feedback, certain questions were changed to more adequately reflect the course work, and the pretest was shortened from 50 to 33 questions to match the length of the exit exam. The tests should be more valid as a result of these changes.

Stage two of the program evaluation concentrated, therefore, on reexamining MAT 002 in depth in light of the testing changes made. Also emphasized were follow-ups from the Spring to the Fall semester, which examined how well students did in succeeding courses.

2. MAT 001 Overview-Fall 1988

In the Fall 1988 semester, 248 students enrolled in MAT 001. As a result of in-class pretesting, five students were reassigned into MAT 002.

The grade distributions for this course for the Spring and Fall semesters appear below. (Grades of "I" have been omitted)

	Spring 1988	Fall 1988
S	75 (58.6%)	149 (58.7%)
U	50 (39.1%)	85 (33.5%)
W	3 (2.3%)	14 (5.5%)

It is apparent that the passing rate remained very stable from one semester to the next.

The pretest was taken by 240 students. The average pretest score was approximately 42%. At the end of the semester, 145 students took the exit exam. Approximately 39% of the students did not take the exit exam, although all attending students were given the opportunity of doing so. In Spring 1988, this figure was approximately 34%.

The average grade on this exam was approximately 79%, which was the minimum score needed to receive an S in the course. This figure is essentially the same as Spring 1988, when the mean exit exam grade was approximately 78%.

3. Mat 002 Overview - Fall 1988

In-class Pretesting

In the Fall 1988 semester, 621 students enrolled in Mat 002. As a result of in-class pretesting, 59 students were reassigned from Mat 002 into a credit course. This represents an increase in Mat 002 reassignments from 3.8% in Spring 1988 to 9.5% in Fall 1988. We can conjecture that test revisions and more complete pretesting in the fall semester were related to this increase.

Grade Distributions

The grade distributions for Mat 002 are shown below.

	S	U	W	I
Fall 1988	97 (63.9%)	188 (30.3%)	35 (5.6% |	1 (0.2%)
Spring 1988	173 (48.7%)	149 (42.0%)	31 (8.7%)	2 (0.6%)

The passing rate was up substantially, from 48.7% in Spring 1988 to 63.9% in Fall 1988.

"Passing" rates (A-C) in entry-level credit math courses ranged from a low of 59.0% to a high of 63.7%, with an overall mean of 62.5%. The Mat 002 passing rate was essentially the same as this.

	MAT 100	MAT 101	MAT 102	MAT 109	MAT 116
A - C	408 (63.3%)	906 (63.7%)	1002 (63.3%)	574 (59.0%)	55 (63.2%)
Other	232 (36.7%)	508 (36.3%	581 (36.7%)	399 (41.0%)	32 (36.8%)

Exit Exam Scores

We can use the exit exam score to assign a course grade equivalent, representing what grade the student might have received if letter grades were available instead of just S, U, etc. The resulting grade distribution is shown below, where it is compared to the grades given in Mat 100, 101, 102,109 and 116 combined. (Grades other than A-F have been excluded.)

MAT 002 Exit Exam Grade Equivalents - Fall 1988

	A	B+	B	C+	C	D+	D	F
MAT 002	13.6%	12.6%	8.0%	19.7%	26.0%	3.7%	4.0%	12.4%
MAT 101-109, 116	25.4%	14.3%	14.9%	10.6%	15.6%	3.8%	7.3%	8.1%

For Mat 002, 79.9% of the 427 students who took the exit exam received a grade of at least C on it. In the other courses 80.8% of the students who completed the course received a grade of at least C. Relatively fewer of these Mat 002 students earned an A to B and relatively more earned a C or C+ than did students in the other courses. (Of course, in other courses the final exam is not usually the sole determination of the course grade, so the situations are not entirely parallel.)

Gain Scores

As in Spring 1988, the Mat 002 population as a whole did learn a statistically significant amount over the course of the semester, as measured by the gain in score from pretest to exit exam. On the average, students gained approximately 34.1 percentage points in Fall 1988, essentially the same as the average gain in Spring 1988 (35.7 percentage points).

High School Deciles

In Spring 1988, among Mat 002 students passing rates of below 50% were found for students in the 9th and 10th high school deciles. In Fall 1988, the passing rate for students in each high school decile were above 50%. However, in each semester students in the 9th or 10th high school deciles and the GED students had the lowest passing rates.

	Mat 002 Spring 1988		Mat 002 Fall 1988	
H.S. Decile	N	% S	N	% S
1	0	--	1	100
2	1	100	3	66.7
3	2	50.0	11	63.6
4	0	--	18	77.8
5	7	57.1	32	62.5
6	8	87.5	55	70.9
7	8	62.5	61	70.5
8	9	66.7	96	64.6
9	13	53.8	89	60.7
10	11	45.5	73	52.1
GED	14	71.4	28	57.1
None	53	52.7	154	65.6

4. Follow-up: How well Do Students Who Took Mat 001 Do in Mat 002?

Pretest Scores

A total of 25 students who had taken Mat 001 and passed that course during a previous semester enrolled in Mat 002 in Fall 1988 (BEP students have been excluded from this analysis.)

The former Mat 001 students were weaker initially in elementary algebra than the students placed directly into Mat 002. Their average in-class Mat 002 pretest score was 30.6%,compared to a mean of 40.1% for students placed directly into Mat 002. This difference was statistically significant at the .05 level. This supports the contention that students scoring low on the math portion of the College's placement test are weak not just in elementary arithmetic and problem-solving, but in algebra as well.

Gain Scores

Although they started out with less initial knowledge of the Mat 002 subject matter, the former Mat 001 students learned comparable amounts over the course of the semester. The former Mat 001 students gained an average of 38.2 percentage points from the in-class pretest to the exit exam; the other group gained an average of 32.2 points. This difference is not statistically significant at the .05 level.

Exit Exam Scores - Grade Distributions

A statistically significant difference in the exit exam scores did exist between these groups, however. Students placed into Mat 002 attained an average score of 73.9% on the exit exam; the average score attained by the former Mat 001 students was 69.5%. Apparently, the fact that the former Mat 001 students knew less of the material at the end of the term can be traced to the fact that they knew less at the beginning of the term, and not to how much they learned.

Despite this, if we look only at whether students knew enough to pass (a minimum grade of 70%) and not how much they actually knew, we find that there was no statistically significant difference in the Mat 002 passing rates between the two groups. Approximately 56.0% of the former Mat 001 students passed the course, compared to a passing rate of 65.1% among students placed directly into Mat 002.

Mat 002 Grade (Fall 1988)

	S	U or W
Students From Mat 001	14 (56.0%)	11 (44.0)%
Students Placed Into Mat 002	201 (62.8%)	119 (37.2%)

Mat 002

	Mean Pretest Score	Mean Gain Score	Mean Exit Exam Score
Students From Mat 001	30.7% (N = 17)	38.2% (N = 12)	69.5% (N = 19)
Students Placed Into Mat 002	40.1% (N = 295)	32.2% (N = 210)	73.9% (N = 233)

5. What Other Variables Are Related To Whether Or Not Students Passed Mat 002?

Pretest Score

Students who passed Mat 002 in Fall 1988 had scored higher on the pretest than those who did not pass.

The mean pretest score for the students who passed was 40.8%; the mean score for those students who did not pass was 35.1%. At the .05 level, this difference is statistically significant.

Gain

Students who passed Mat 002 in Fall 1988 learned more over the course of the semester than those who did not pass but did "complete" the course (as evidenced by their taking the exit exam.)

Those who did pass the course gained an average of 36.5 percentage points from pretest to exit exam; those who did not pass gained an average of 21.6 percentage points. This difference is statistically significant at the .05 level.

Exit Exam Score

Students who did not pass the course by definition failed to earn at least a 70% on the exit exam. In general, these students did not even come close to passing.

The mean exit exam grade for students who did not pass the course was 55.3%. This grade would not even earn the student a D in a credit course. The mean score for students who did pass Mat 002 was 78.0%. This difference is statistically significant at the .05 level.

Placement Decile

As was true in Spring 1988, students scoring in deciles 9 and 10 on the mathematics portion of the College's placement exam were assigned to Mat 001 (provided they are not BEP students.) Students scoring in decile 7 and 8 were assigned to Mat 002 (this may include BEP students.) Students scoring in deciles 1 to 6 were assigned to a credit math course, but some chose to enroll in a non-credit course.

The grade distribution of Mat 002 students in Fall 1988, broken down by their math placement decile, is shown in the table that follows: (This analysis includes BEP students.)

Math Placement Decile	Mat 002 Grade	
	S	U or W
0 to 6	8 (80%)	2 (20%)
7	139 (63.8%)	79 (36.2%)
8	119 (68.8%)	54 (31.2%)
9	20 (51.3%)	19 (48.7%)
10	1 (100%)	0 (0.0%)

A chi square test of independence was done and the resulting value was determined not to be significant at the .05 level. Thus, a student's grade in Mat 002 was not shown to be related to his or her math placement decile score, in general. The same is true if we omit the students in deciles 0 to 6, who need not have enrolled in the course.

Student math placement decile score was found to be related to pretest score and exit exam score, however, although not to the change from one to the other.

The statistically significant difference in pretest scores across deciles was traced to the difference in scores between students in decile 7 and those in deciles 8 and 9 (there was only 1 student in decile 10.) The means for these groups are shown below:

MATH PLACEMENT DECILE	MEAN PRETEST SCORE
1-6	42.8% (N = 10)
7	41.6% (N = 218)
8	36.9% (N = 174)
9	29.9% (N = 39)
10	33.0% (N = 1)

Thus, the initial knowledge of algebra of students in decile 7 was higher than that of students in deciles 8 and 9.

The statistically significant difference in exit exam scores was traced to the difference in scores betweens students in deciles 1 to 6 and students in decile 9.

MATH PLACEMENT DECILE	MEAN EXIT EXAM SCORE
0 - 6	83.5% (N = 10)
7	74.9% (N = 157)
8	73.0% (N = 127)
9	65.8% (N = 26)
10	70.0% (N = 1)

This indicates the students who had not originally actually placed into a non-credit course knew more in the end than the students who had originally placed into a course below Mat 002 and were now up to taking Mat 002.

Area of Interest (Major)

Grade distributions

Students enrolled in Mat 002 belonged to 47 different areas of interest. The enrollment figures and grade distribution broken down by area appear in Table 1 which follows:

Table 1

Grade Distribution by Area of Interest - Mat 002
Fall 1988

Area of Interest	Number of Students	Grade S	Grade U or W
Asst Acct	4 (0.7%)	75.0%	25.0%
Acctg.	4 (0.7%)	50.0%	50.0%
Afro-Amer St.	1 (0.2%)	100%	0%
LA/Art	6 (1.0%)	100%	0%
Bookkeeping Ctf	1 (0.2%)	100%	0%
LA/Biology	1 (0.2%)	0%	100%
Advertising Art Ctf	1 (0.2%)	100%	0%
Crim Just-AS	17 (2.9%)	70.6%	29.4%
Bus Admin	22 (3.8%)	86.4%	13.6%
Sec Sci	11 (1.9%)	63.6%	36.4%
Child Care	3 (0.5%)	33.3%	66.7%
Data Proc	8 (1.4%)	87.5%	12.5%
LA/Pre Envr Sci/Fors	1 (0.2%)	0%	100%
LA/Pre Tech	-12 (2.0%)	75.0%	25.0%
Civil Tech	6 (1.0%)	100%	0%
Electr Tech	6 (1.0%)	50.0%	50.0%
Fashion Merch	23 (3.9%)	65.2%	34.8%
LA/Info Proc	3 (0.5%)	100%	0%
Paralegal	3 (0.5%)	33.3%	66.7%
LA/AA	185(31.6%)	59.5%	40.5%
LA/As	21 (3.6%)	57.1%	42.9%
LA/BEP	122(20.8%)	76.2%	23.8%
LA/ESL	4 (0.7%)	50.0%	50.0%
Hotel Tech Adm	7 (1.2%)	71.4%	28.6%
Marketing	20 (3.4%)	65.0%	35.0%
Real Est Ctf	3 (0.5%)	66.7%	33.3%
LA/Math	1 (0.2%)	100%	0%
Computer Sci	1 (0.2%)	100%	0%
Med Lab Tech	1 (0.2%)	0%	100%
LA/Music	1 (0.2%)	100%	0%
Phys Ther Asst	1 (0.2%)	100%	0%
Early Childhood	18 (3.1%)	38.9%	61.1%
Nursing	1 (0.2%)	100%	0%
Photog Ctf	1 (0.2%)	0%	100%
LA/Health Ed	1 (0.2%)	100%	0%
LA/Phys Ed Men	1 (0.2%)	100%	0%
Crim Just-A.A.S.	14 (2.4%)	28.6%	71.4%

Security Adm	1 (0.2%)	100%	0%
LA/Public Adm	1 (0.2%)	0%	100%
Music-A.A.S.	4 (0.7%)	75.0%	25.0%
LA/Acting	1 (0.2%)	0%	100%
LA/Dance	4 (0.7%)	75.0%	25.0%
LA/Tech Thtre	1 (0.2%)	100%	0%
Retail Mgmt	7 (1.2%)	85.7%	14.3%
LA/Allied Health	3 (0.5%)	66.7%	33.3%
Restaurant Mgmt	12 (2.0%)	75.0%	25.0%
Word Proc	5 (0.9%)	40.0%	60.0%
Total		65.9%	34.1%

A chi square test of independence was done on the grade distribution and the resulting value was determined to be statistically significant at the .05 level. Thus, course grade is related to area of interest.

Unfortunately, this doesn't tell us anything about whether the source of the significance is the difference between any particular groups.

There are only 11 groups containing at least 2% of the total student enrollment. Confining ourselves to these groups we see that the lowest passing rates were for the Early Childhood students (38.9%) and the criminal Justice-A.A.S. students (28.6%). The highest passing rates were for the Business Administration students (86.4%) and the LA/BEP students (76.2%).

Pretest, gain scores, exit exam

There was no statistically significant difference in the scores earned by different "majors" on the pretest. Students of different majors (who did not place out of the course as a result of pretesting) had the same initial knowledge of algebra on average. However, there was a statistically significant difference (.05 level) across majors in how much they improved from pretest to exit exam, although no two particular groups are significantly different.

The average gain was approximately 34.1 points. Only the Early Childhood group, with 11 students taking both pretest and exit exam, had a mean gain, 23.5 percentage points, the 95% confidence interval for which (17.3 to 29.6) is lower than the overall mean of 34.1 points. That is, 95% of the time the gain for a student in this group will be less than the mean gain for all Mat 002 students.

Students of different areas of interest had the same initial levels of knowledge of Mat 002 content, but learned different amounts. As a result, the final level of knowledge, as measured by the exit exam, differed across student areas of interest. There was a statistically significant difference (.05 level) in the scores earned on the exit exams; however, no particular groups had significantly different exit exam scores.

The overall mean exit exam score for Mat 002 students was 74.0%. A score of at least 70 is needed to pass. Only the group of 10 secretarial science students had a mean exit exam score, 50.3%, whose 95% confidence interval (31.1% to 69.5%) was lower than the overall mean. That is, 95% of the time the exit exam score for a student in this group will be lower than the mean score for all Mat 002 students.

6. Follow-up: How Well Do Students Who Took Mat 002 Do In A Credit-bearing Mathematics Course?

A total of 82 students who passed Mat 002 in the Spring 1988 semester enrolled in a math course during Fall 1988. The courses in which these students may enroll are Mat 100, Mat 101, Mat 102, Mat 109, and Mat 116. The grade distribution for these students in their next math courses appears in Table 2, which follows:

Table 2

Follow-up: From Mat 002 (Spring 1988)

To Credit Math Course (Fall 1988)

Former Mat 002 Students

	Mat 100	Mat 101	Mat 102	Mat 109	Mat 116	TOTAL
Number of Students	22	18	12	17	13	82
% A - C	40.9	27.8	66.7	52.9	61.5	47.6
% D- F	13.6	27.8	8.3	11.8	30.8	18.3
% W	45.5	44.4	25.0	35.3	7.7	34.1

Entire Population

	Mat 100	Mat 101	Mat 102	Mat 109	Mat 116	TOTAL
Number of Students	645	1422	1583	973	87	4710
% A - C	63.3	63.7	63.3	59.0	63.2	62.5
% D - F	15.0	15.4	15.0	15.3	20.7	15.3
% W	20.9	20.3	18.4	24.8	16.1	20.6

There was a statistically significant difference (.05 level) between the grade distribution for former Mat 002 students and what we might expect based on the comparable distribution for the entire population of these credit courses.

Overall 47.6% of these students "passed" (A-C) their first credit-bearing math course, compared to a 62.5% passing rate for these courses overall. In three of these courses, Mat 102, 109, and 116, the passing rates for the former 002 students were comparable to the overall passing rates, ranging between 52.9% and 66.7%. Where the former 002 students seemed to have had the most difficulty was with Mat 101 and, to a lesser extent, Mat 100. Their passing rates for these courses were 27.8% and 40.9%, respectively. The courses in which they do best are those which depend most on the material learned in Mat 002; the course in which they do least well depends least on the material learned in Mat 002.

This is not true for students in general. The passing (A-C) rate was lowest in Mat 109, and essentially the same for the other Mat courses under discussion.

These results might be important to keep in mind when advising students.

7. Summary of Results

As detailed in the report, the following generalizations are suggested by the data from the Fall 1988 Semester.

1. The passing rate in Mat 001 remained stable from the Spring 1988 to the Fall 1988 semester.

2. The passing rate in Mat 002 was substantially higher in the Fall 1988 semester than in the Spring 1988 semester. Improved test validity may have contributed to this. The Fall 1988 passing rates were essentially the same for Mat 002 as for the entry-level credit math courses.

3. Student's mathematics abilities improved as a result of taking Mat 002. The average improvement was essentially the same in each semester.

4. Former Mat 001 students knew less Mat 002 course content at both the beginning and end of the term than other students, but improved the same amount. Although they knew less at the end of the term, they did learn enough to pass at the same rate as other students.

5. Students who passed Mat 002 in Fall 1988 knew more course content at the beginning and end of the term, and learned more than students who did not pass.

6. Neither grade in Mat 002 nor amount learned (gain score) were shown to be related to college math placement test score. However, students in decile 7 knew more at the beginning of the term than students in deciles 8 and 9. In addition, students who had not originally been placed into a non-credit course knew more at the end of the course than students who had been placed into a course below Mat 002.

7. Course grade (S/U or W) and amount learned in Mat 002 in Fall 1988 were related to student area of interest. However, no general trends could be identified. Students of different majors had the same initial knowledge of the course content, on average.

8. Former Mat 002 students did best in Mat 102, 116, and 109, passing at about the same rate as other students. They did less well in Mat 100 and most poorly in Mat 101, passing at lower than average rates in each of these courses.

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